

**MODULAR APPROACH TO THE NEXT GENERATION, SHORT
WAVELENGTH, LASER-LIKE LIGHT SOURCES**

Abstract of the Disclosure

5 A system and method for implementing a next generation laser-like
light source with Free Electron Lasers (FELs) are provided whereby the
construction of a Free Electron Laser (FEL) is customized through the use of
individual modules having specified characteristics. Such individual modules
include conventional lasers, electron guns, linear accelerators, magnetic
bunch compressors and permanent magnet, hybrid, and electromagnetic,
10 undulators or a combination of these undulators. These individual modules
are arranged to exploit the occurring fundamental and nonlinear harmonics
generated in each SP HG FEL to be used themselves as a light source, or
alternatively to be a coherent seed for another module, such as, in high-gain
harmonic generation (HGHG). An efficient method for producing shorter
15 wavelengths of a synchrotron light source is provided. A three step process
including imprinting, upconverting or wavelength shifting and reinforcing or
strengthening of the electron beam microbunching is provided. The modular
FEL is designed and constructed to meet specific user requirements in the
most cost-effective manner. The modular single-pass, high-gain Free
20 Electron Laser (SP HG FEL) significantly reduces the size and cost of FEL
machines, obtains the shortest wavelength, has the ability to tune the output
wavelength, and retains the coherence quality of the seed laser.